On-site Application of the VHF Partial Discharge Detection Method for the Underground Power Cable Terminations

Shin Sub **Kang**, Jae Seop **Lim**, Sangsuh **Park**, Yu Won **Kang**, Tae Hyueng **Roh**, Jae Seung **Kim**, Jong Chae **Kim**, Gye Hyun **Joh**, Youn Chan **Kim;** (KEPCO), (KOREA), issul5858@kepco.co.kr, limjs@kepco.co.kr, sang36@kepco.co.kr, ywkang7@kepco.co.kr, danpung@kepco.co.kr, kjs12@kepco.co.kr, jongchaekim@kepco.co.kr, ggmell@kepco.co.kr, chanchany@kepco.co.kr

ABSTRACT

The following research paper provides a method of detecting signals in the VHF/UHF wideband used in the GIS (Gas Insulated Switchgear) as a measuring technology for EHV underground power cables. The PD sensors which can measure in frequencies ranging from 2 to 400MHz and were used for performance testing in construct systems and in spot adoption. The measurement system was established by using a frequency analyzer that could analyze frequencies in the VHF/UHF wideband in order to analyze PD in the termination kit. The field test implemented by the measurement system in the VHF/UHF wideband is included in the paper. As a result, the VHF wideband frequency measuring method is presented to replace the downside of the HF wideband measurement method.

KEYWORDS

Partial Discharge, PD, HF, VHF, UHF, Termination

INTRODUCTION

In this paper, we will introduce VHF partial discharge method for the terminations of underground power cables. The reality is that underground cables' measured frequency range for partial discharge is HF(1~50MHz) because the signal reduction characteristics are very large in high frequencies due to the high capacitance of the internal insulator within the XLPE underground power cables. External noise and partial discharge signals are mixed due to the operation conditions of the sealing end of the underground power cables, while the current measuring device for partial discharge cannot differentiate between the noise and partial discharge signals. The sensitivity of measuring partial discharge signals over ground such as in a termination kit tends to drop compared to the kit in the tunnel or manholes.

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The experiment to test the EBO(End Box in Oil) of the Transformer was held by the mock system. The existing measurement system and the VHF wideband measurement system were organized and applied both. HF wideband testing was used first to test for PD generation, which resulted in a PD generation caused in C phase according to the test. However, after the noise reduction analysis, the PD signals does not seem to be generated in the EBO.

The VHF measurement system was implemented to measure and analyze the frequency analysis mode and PRPDA zero span mode going up until the 180MHz region at the same place. The intensity diminished as the frequency region was heightened, and no PD was detected from 200MHz and up. From this result, it could be seen that external signals coming from the outside can only be detected under 200MHz.

As a result, in termination kits above ground, the VHF wideband frequency measuring method was presented to replace the downside of the HF wideband measurement method. A measurement system and software have been developed, and the possibilities of partial discharge in the VHF wideband was verified through the mock testing. This test showed that external noise would only be detected up to 200MHz. [4-6]

DEVELOPMENT AND APPLICATION OF A VHF MEASUREMENT SYSTEM

VHF wideband measurement sensor

The sensors that we developed were used, with the specifications listed below on Table 1. The sensors measure frequencies ranging from 2~400MHz and were used for performance testing in construct systems and in spot adoption.

Table 1: Specifications of the applied sensor

		Model HFCT-400M-40D
Image		
Frequency		2MHz ~ 400MHz
S21	dB	<15dB
	Range	2MHz ~ 400MHz